Scientists are offering the first detailed analysis of the crater formed when a NASA rocket slammed into the Moon last fall and information about the composition of soil at the lunar south pole. The findings, which report the presence of significant amounts of water on the Moon, are published in a set of papers in *Science* (22 October 2010) stemming from the mission, called LCROSS for Lunar CRater Observing and Sensing Satellite.   
  
Mission control at NASA Ames sent the emptied upper stage of a rocket crashing into the Cabeus crater near the Moon's south pole last October. A second spacecraft followed to analyze the ejected debris for signs of water on the Moon and for other constituents of the ejected material.   
  
In one of the papers, planetary geologist Peter Schultz of Brown University, along with NASA scientists, says the cloud kicked up by the rocket's impact showed the Moon's soil is more complex than previously believed: Now not only is it clear that there is lots of water on the Moon — at least at the impact site — but also that the ejected soil contained other compounds, such as carbon dioxide, carbon monoxide, hydroxyl, ammonia, free sodium, and silver.   
  
Combined, the particular assortment of elements and compounds observed gives scientists clues where they came from and how they got to the polar craters, many of which haven't seen sunlight for billions of years and are among the coldest spots in the solar system.   
  
Schultz, lead author on the *Science* paper detailing the impact crater and the ejecta cloud, thinks many of the volatiles originated from the comets, asteroids and meteoroids that have pummeled the Moon. He thinks an assortment of elements and compounds, deposited in the soil all over the Moon, could have been quickly liberated by later small impacts or could have been heated by the sun, supplying them with energy to escape and move around until they reached the poles, where they were trapped beneath the shadows of the frigid craters.   
  
"This place looks like it's a treasure chest of elements, of compounds that have been released all over the Moon," Schultz said, "and they've been put in this bucket in the permanent shadows."   
  
Schultz believes the variety of volatiles found in Cabeus crater's soil implies a kind of tug of war between what is being accumulated and what is being lost to the tenuous lunar atmosphere.   
  
"There's a balance between delivery and removal," explained Schultz, who has been studying the Moon since the 1960s. "This suggests the delivery is winning. We're collecting material, not simply getting rid of it."   
  
Astronauts sent as part of NASA's Apollo missions found trace amounts of silver, along with gold, on the near side of the Moon. The discovery of silver in the Cabeus crater suggests that silver atoms throughout the moon migrated to the poles.   
  
The crater formed by the rocket's impact within Cabeus produced a hole 70 to 100 feet in diameter and tossed up six-foot deep lunar material. The plume of debris kicked up by the impact reached more than half a mile above the floor of Cabeus, high enough to rise into sunlight, where its properties could be measured for almost four minutes by a variety of spectroscopic instruments. The scientists noted a slight delay, lasting roughly one-third of a second, in the flash generated after the collision, which indicates the composition of the crater floor may be different than the loose, almost crunchy surface trod by the Apollo astronauts.   
  
"If it had been simply lunar dust, then it would have heated up immediately and brightened immediately," Schultz said. "But this didn't happen."   
  
Even though the mission has been judged a success, Schultz said it poses at least as many questions as it answered.   
  
"There's this archive of billions of years (in the Moon's permanently shadowed craters)," Schultz said. "There could be clues there to our Earth's history, our solar system, our galaxy. And it's all just sitting there, this hidden history, just begging us to go back."

Last fall a NASA rocket slammed into the moon and formed a crater this article is talking about this crater. NASA is saying that there may be water on the moon. The crater was about 70-100 meters in diameter and threw up lots of lunar dust. The rocket hit a soft part of the moon were when Apollo landed they landed on a very stable part of the moon. There’s a lot of scientist looking at this incident and trying to determine whether there’s water on the moon or not at least in liquid form.